

# Application Note TDx5101x

## Low Power Antenna Board for Japanese Market

Version 1.0

Wireless Communication



Never stop thinking.

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Previous Version: none

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Page	Subjects (major changes since last revision)

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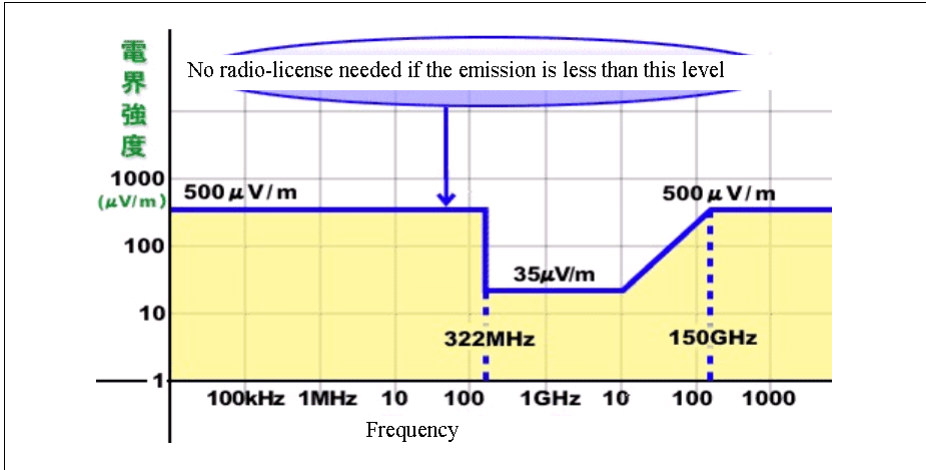
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# 1 Introduction

In Japan operation of RF-Transmitters is allowed without any license if the field-strength at 3m distance is below the limits given in Figure 1:



**Figure 1 Japanese Radio Regulations**

As can be easily seen the maximum field strength at 315MHz is 500  $\mu\text{V/m}$ , which is quite low. So the output power of our TDx5101x-transmitters has to be reduced by more than 20dB using a special design of the antenna-matching circuit. Also care has to be taken on the harmonic emissions since the maximum field strength is 35  $\mu\text{V/m}$  there. This requires some additional filtering.

## 2 TDK5101F Antenna-Board

### 2.1 Schematic

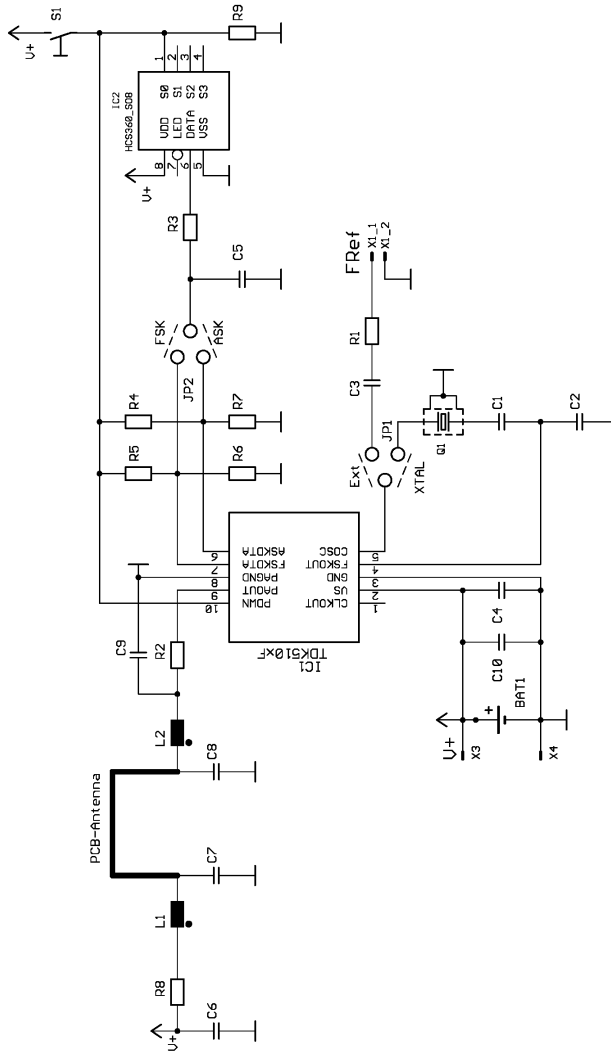


Figure 2 Antenna Board Schematic

## 2.2 Layout

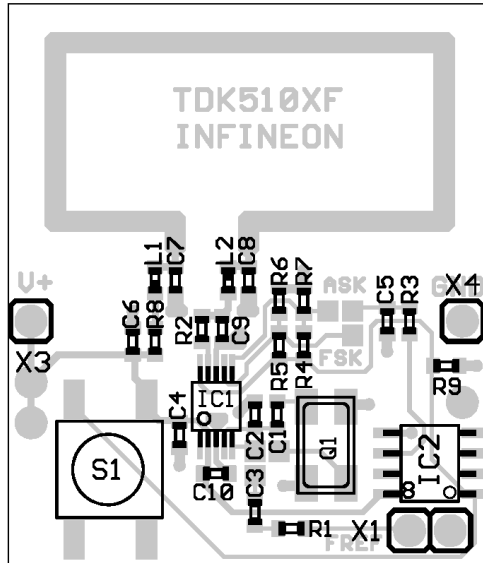


Figure 3 AntennaBoard\_TOP

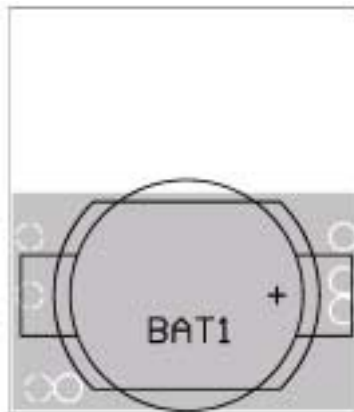


Figure 4 AntennaBoard\_Bottom



## 2.3 Bill of Materials

**Table 1 BOM Table**

	<b>FSK-Mode</b>	<b>ASK-Mode</b>	
R1	open	open	
R2	0R	0R	0603, SMD-Jumper
R3	0R	4k7	0603, +/-5%
R4	open	open	
R5	0R	0R	0603, SMD-Jumper
R6	0R	4k7	0603, +/-5%
R7	82k	open	0603, +/-5%
R8	4k7	4k7	0603, +/-1%
R9	15k	15k	0603, +/-5%
C1	15p	15p	0603, COG, +/-1%
C2	6p8	6p8	0603, COG, +/-0,1p
C3	open	open	
C4	open	open	
C5	open	1nF	0603, X7R, +/-10%
C6	10n	10n	0603, X7R, +/-10%
C7	330p	330p	0603, COG, +/-10%
C8	18p	18p	0603, COG, +/-1%
C9	10p	10p	0603, COG, +/-1%
C10	47n	47n	0603, X7R, +/-10%
L1	0R	0R	0603, SMD-Jumper
L2	39n	39n	0603, EPCOS SIMID, +/-2%, B82496C3390G
S1	push-button	push-button	STTSKHMPW, ALPS
Q1	9843.75 kHz, CL=12pF	9843.75 kHz, CL=12pF	Tokyo Denpa TSS-3B 9843.75 kHz Spec.No. 1053-921
IC1	TDK5101F	TDK5101F	P-TSSOP-10
IC2	HCS360	HCS360	SO8, Microchip
BAT1	battery-holder	battery-holder	HU2031-1, Renata

## 2.4 Measurement Results

**Table 2 Measurement Results**

Fundamental:	400 $\mu\text{V/m}$
Harmonics:	<35 $\mu\text{V/m}$
Current Consumption:	5.4 mA

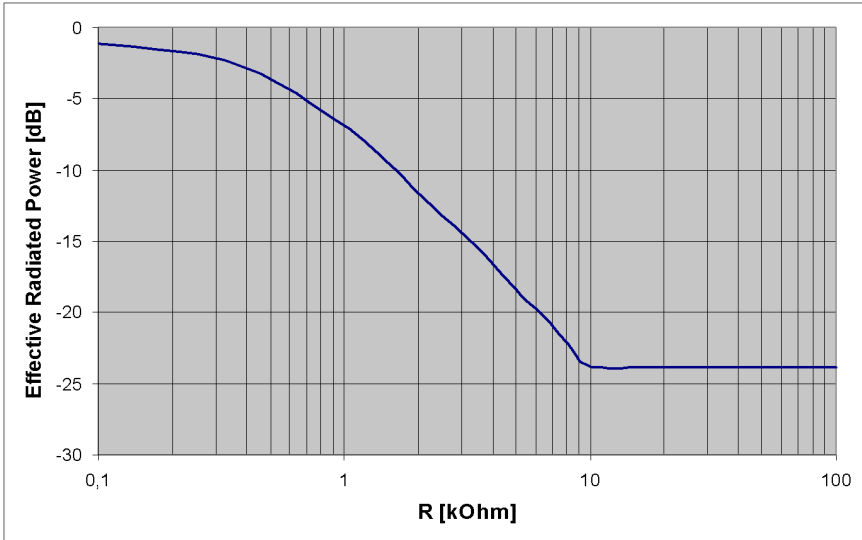
### **3 TDx5101 Antenna-Board**

The antenna board of the TDx5101 (16-pin-package) can be found in the specification of the TDA5101. However, investigations revealed that the PA-biasing-resistor R4 has to be changed from 1 kOhm to 4.7 kOhm in order to comply with Japanese Radio Regulations.

## 4 Design Considerations

### 4.1 Output Power

Figure 5 shows the effective radiated power as a function of the biasing-resistor.



**Figure 5 Effective Radiated Power as a function of the biasing resistor**

On our low-power-evalboards for the Japanese Market a PA-biasing-resistance of 4.7 kOhm is used.

Above 9 kOhm the output power is not dependant on the biasing resistor any more due to RF-leakage. That's why the PA-biasing-resistance must not exceed 6.8 kOhm in order to avoid this operating region.

### 4.2 Stability

The evalboards described above are stable over mass-production.

However, if less efficient antennas are used in the application, the PA-biasing-resistor would have to be decreased in order to compensate the additional losses in the antenna. When using a biasing resistor below 3.3 kOhm, an additional resistor of approximately 18 Ohm has to be used in series to the antenna loop in order to damp spurious resonances.

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